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BIOLOGICAL EVALUATION OF BARK BEETLES

JULIAN-CUYAMACA ZONE OF INFESTATION

AND

DESCANSO DISTRICT, CLEVELAND NATIONAL FOREST

By

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Introduction

A biological evaluation of bark beetles in the Laguna Mountains was conducted by Forest Service and California Division of Forestry entomologists April 16, 1975. Assistance from the Cleveland National Forest was given by George Lottritz, Resource Officer, Descanso District. Tree mortality on both private and National Forest lands was examined for collection of host-pest data collected.

Management direction for National Forest land on the Laguna Mountain Plateau is to improve, maintain, or restore optimum conditions for mountain type recreation. The Secretary of Agriculture declared the Plateau a recreation area in 1926. Private lands are used as (1) homesites for summer and permanent residents, (2) camps for organizations, (3) sites for commercial establishments, and (4) mountain pastures for livestock.

The Laguna Mountain Plateau represents the largest block of coniferous forest in San Diego County. Visitor use days on the Plateau on National Forest land totaled 625,000 for Fiscal Year 1974. The Mountains lie 60 miles east of the greater San Diego area with its 1.5 million residents.

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Background

Direct suppression of bark beetles commenced in 1929 in the Laguna Mountains when 129 trees were treated using the fell, peel and burn method. Suppression proceeded on an intermittent basis until 1952. Since then, suppression has been conducted annually. The California Forest Pest Control Action Council has approved the suppression projects annually since 1957.

Forest Service crews treated an average of 663 infested trees each year between fiscal 1955-74 on federal land. Trees treated on private lands averaged 98 from fiscal 1967-74. Partial treatment on private lands was accomplished by the Forest Service through fiscal 1972. A cooperative agreement between the Forest Service and the California Division of Forestry in 1973 transfered responsibility for bark beetle suppression on private lands to the California Division of Forestry.

Causal Agents and Hosts

The major forest insect pest on the Laguna Mountain Plateau remains the California flatheaded borer, Melanophila californica, which attacks Jeffrey pine, Pinus jeffreyi. The most important insect pest of Coulter pine, Pinus coulteri, is the western pine beetle, Dendroctonus brevicomis. The red turpentine beetle, Dendroctonus valens, and pine engraver beetles, Ips spp., attack both pine species.

Jeffrey pine comprises over 90 percent of the conifers on the Laguna Mountains. Pure stands of all age classes are common. Mixed stands include a small amount of Coulter pine, and the non-host species, incense-cedar, Libocedrus decurrens, and black oak, Quercus kelloggii.

Location and Extent of Infestation

The infestation extends throughout the timbered portions of the Laguna Mountains in San Diego County (Figs. 1). There are approximately 7,200 timbered acres of National Forest land and 2,150 timbered acres of private land on the Plateau.

The District has on file a long-range insect suppression plan which delineates the infestation areas on National Forest land into treatment

intensity classes and work priorities in accordance with R-5 Emergency Directive No. 1, FSM 5242. Private timberlands on the Laguna Mountain Plateau have also been delineated into intensity classes and work priorities in order to coordinate control activities. Intensity is broken into four classes, with Class I designated to receive continuous treatment and Class II to receive seasonal treatment. Work priorities are Categories A (1st priority), B (2nd priority), and C (3rd priority), and only apply to intensity Classes I and II. There are 680 acres in Classes III and IV which are low-use areas that require separate evaluations before suppression can be approved for funding.

Acreage figures for Federal and private timberland by work priorities are shown below for intensity Classes I and II.

Acreage of Federal and Private Timberlands by Work Priority

Work Priority	Federal	Private	Total
A	2,700	740	3,440
B	2,820	700	3,520
C	1,000	710	1,710
Total	6,520	2,150	8,670

Type of Damage

California flatheaded borer and pine engraver beetles cause branch, partial bole, and complete mortality of Jeffrey pine. The western pine beetle kills Coulter pine either alone or in combination with other bark beetles and/or diseases. The red turpentine beetle weakens both Jeffrey and Coulter pines through bole attacks near the ground line which extend often down into major roots. Mortality can occur from red turpentine beetle attacks; however, normally flatheaded border and/or engraver beetles are involved also.

Environmental Factors

Environmental factors can adversely affect tree resistance to bark beetles. Factors which significantly affect tree resistance on the Plateau are plant pathogens, site, moisture, fire and recreation.

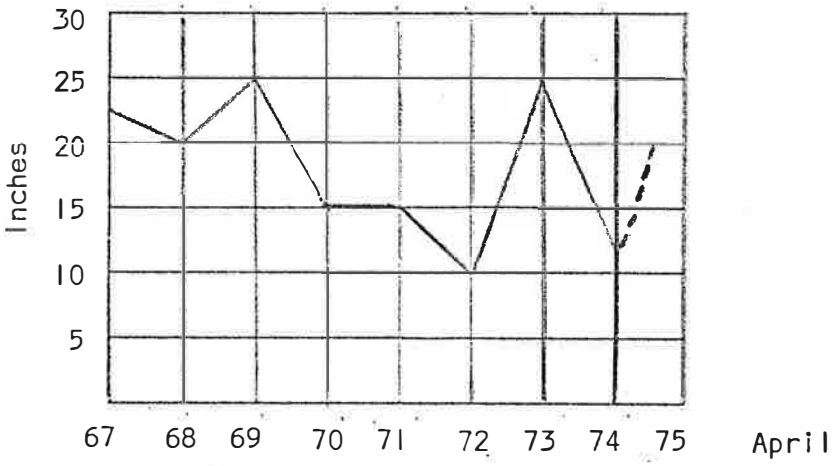
Plant pathogens. The dwarf mistletoe, Arceuthobium campylopodum was shown associated with California flatheaded borer during a 1957 survey by Trostle (5). Fifty percent of the smaller diameter trees contained both pests, and 100 percent of the larger diameter trees. An earlier report by Wagener tells of the relationship of A. campylopodum and a weevil, Cylindrocopturus sp. in causing pine mortality (6). The District has mapped dwarf mistletoe infected areas in the Laguna Mountains. A total of 1,800 acres of the 7,200 forested acres is infected.

Annosus root rot, Fomes annosus causes significant mortality in the Laguna Mountains. Shoestring root rot Armillaria mellea, is also common (6). An association of needle blight, Elytroderma deformans, with insect attack was made by Cox (1).

Site and Moisture. The Laguna Mountains are marginal lands for Jeffrey pine with sites IV and V common. Pure stands of Jeffrey pine grow where annual precipitation reaches only 18 inches but growth is more rapid where annual precipitation exceeds 30 inches (2). Precipitation for the Laguna Mountains is given in the graph below. The average annual precipitation since 1967 has been 18.5 inches. However, personnal on the Descanso District feel the long term average would be between 20 and 25 inches.

Laguna Mountain Precipitation Records

(Courtesy Mrs. Hawk)



1/ Environmental Analysis and Report, Laguna Sanitation Timber Harvest Program, Cleveland National Forest. Forest Service, San Diego, California, file 8310, 10/10/74.

Fires. The vegetational composition in the Laguna Mountains has historically been influenced by fire. Two recent fires, the Laguna in 1970 and the GATR in 1972, burned 1000 and 80 forested acres respectively. Most dead material was removed through fuelwood permits; however, some logging and burying of logs was also done. Cursory observations indicate the residual stand in the Laguna burn has increased in vigor. Much plant competition was eliminated and now fewer bark beetle killed trees occur in and around the burn.

Recreation. The Laguna Mountains contain the largest block of public owned coniferous forest in San Diego County, 7200 acres. Developed sites include 7 campgrounds, 2 picnic areas, 2 organizational sites, 169 summer homes, 100 trailer spaces and 12 cabins. These offer the main forest recreation facilities available to the San Diego County populace. The continuous use of these recreation sites stresses trees through soil compaction from vehicle and foot traffic, mechanical injury to roots and stems, and lowering of the water table.

Biological Information

Tree mortality was ground checked at two sites on the Laguna Mountain Plateau: the Laguna campground which contains 52 acres of National Forest land, and an 11-acre private tract with residences. Thirty-one infested Jeffrey pine were found on the combined 63 acres or .49 trees per acre. All 31 trees were infested with the California flatheaded borer. They were mainly in the pre-pupal stage in the outer bark.

The dbh ranged from 4-26 inches and the height from 12-75 feet, with an average of 13 inches and 48 feet respectively. Dwarf mistletoe infections occurred on 29 of the 31 dead trees (94%). Twenty-six trees (84%) were moderately to heavily infected by dwarf mistletoe and 3 trees (10%) were lightly infected. Woodpecker activity was rated as heavy in 50 percent of the trees, moderate on 25 percent, light on 22 percent and none on 3 percent.

Red turpentine beetle was found active and in the late larval stage in one of the dead trees. Old pitch tubes from red turpentine beetle were apparent on approximately 25 percent of the infested trees. Pine engraver beetle was observed in branches of the dead Jeffrey pine but no mortality was attributed to the pest.

Discussion

Ground checks of tree mortality on the Laguna Mountain Plateau were held to a minimum by adverse climatic conditions. Nevertheless, 63 acres

developed for recreation and residences were systematically examined for tree mortality. The 31 dead trees (0.49 per acre) were all infested by California flatheaded borer. If this figure is representative of mortality over the Plateau, then this limited survey would estimate 4,450 trees are currently infested on National Forest and private lands. An extensive appraisal survey in 1961 found 0.49 infested trees per acre with 95 percent of the Jeffrey pine killed by California flatheaded borer (3). The 1974 biological evaluation of bark beetles on the Descanso District (4) reported 3150 infested trees.

The observations on relationship of flathead borer activity and occurrence of dwarf mistletoe substantiates findings by Trostle in 1957 (5). Apparently, reduction of dwarf mistletoe infection either through pruning or thinning of infested trees would serve as a good preventive technique to lessen risk of mortality by California flatheaded borer.

A dwarf mistletoe control program has been in progress in the Laguna Mountains for a number of years. This program should be strengthened along with other silvicultural measures to help increase stand vigor. Additionally, the relationships between root rot, dwarf mistletoe infection, and California flatheaded borer attacks on Jeffrey pine are not fully understood and needs to be studied.

The Laguna Sanitation Timber Harvest which covers 6000 acres of National Forest land is planned for fiscal 1976. It can serve as one tool by which the stand on the plateau can be silviculturally treated to improve the health and vigor of the stand. Most high insect-risk trees will be removed. Competition for available moisture will be lessened through reduced basal area per acre. Also, some trees heavily infected with mistletoe will be removed.

Another silvicultural method employed by the District is thinning. This program has been used to establish fuelbreaks, remove mistletoe infested trees and release overstocked stands. Approximately 600 acres will be thinned in fiscal 1975. Over the next ten years, thinning is planned on 200 acres per year.

A long range program for stand treatment for the National Forest land on the Laguna Mountain Plateau will be prepared. The program should include selection harvests (sanitation-salvage) on a systematic basis to help reduce high risk trees, thinning to reduce basal area where necessary, and thinning and pruning to lessen impact of mistletoe. All these techniques will help reduce mortality caused by the California flatheaded borer.

District personnel should strive to remove infested material through fuelwood sales. Chemical treatment should not be required for infested material that will be moved to non-host areas such as metropolitan San Diego and other low elevation cities. District personnel estimate that fuelwood permits will reach 3000 by the end of fiscal 1975. Approximately 65 percent of these permits are issued to persons who live in non-host localities. Permits allow removal of one cord of wood each or 500 board feet. One cord is equivalent to five 16-inch dbh trees. Therefore, the potential for removal through fuelwood could reach 15,000 16-inch dbh trees: over three times the estimated number of infested trees currently on the Plateau. Fuelwood returns $5.00 per cord or $1.00 per 16-inch dbh tree. Bark beetle suppression with chemical on National Forest land in fiscal 1974 cost $14.07 per tree or $11,062.

Efficacy of bark beetle suppression with lindane should be evaluated during fiscal 1967. Both mortality of bark beetles and protection of the coniferous resource should be considered. This will involve comparisons of brood emergence from treated and untreated infested bolts and comparisons of tree mortality in treated and untreated blocks of timber. This post-suppression evaluation will be conducted by the Forest Pest Control Staff and the California Division of Forestry with assistance from the Forest. A study plan will be sent to the Forest for comments.

Recommendations

1. The Laguna Sanitation Timber Harvest should be initiated on National Forest lands as soon as the long range stand treatment plan is finalized. Private landowners should be encouraged to have their timber marked using the high risk system and removed when logging contractors and their equipment are in the area.

2. The long range program should include thinning and pruning of mistletoe infected areas to improve stand and individual tree vigor and reduce the potential for successful attack by California flatheaded borer. Thinning to reduce stand density and removal of brush where competition for moisture is high should also be used to lessen potential for successful borer attack.

3. Bark beetle infested material should be disposed of through logging and fuelwood sales when outlets are in non-host localities.

4. When necessary, infested trees can be treated with a 1.5 percent lindane spray as outlined in R-5, FSM 5240, Emergency Directive No. 1, May 3, 1968.

5. A survey to determine the pest complexes responsible for tree mortality on the Laguna Mountain Plateau should be conducted cooperatively by personnel from the Forest Pest Control Staff, California Division of Forestry and the Forest.

6. Another biological evaluation of bark beetles should be conducted in April, 1976 by personnel from the Forest Pest Control Staff, California Division of Forestry and the Forest.

7. A post-suppression evaluation will be conducted during fiscal 1976 and a report prepared (RO and CDF responsibility).

References

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(2) Fowells, H.A. 1965. Silvics of Forest Trees of the United States. Agricultural Handbook No. 271, Washington, D.C. pp. 355-357.

(3) Hall, R.C. 1961. Forest Insect Conditions, Mount Laguna Recreation Area, Cleveland National Forest - Appraisal Survey. Pac. SW Forest and Range Expt. Station. Berkeley, California 12pp.

(4) Swain, K., Hunt, D. and M. Ollieu. 1974. Biological Evaluation, Julian-Cuyamaca Zone of Infestation, Laguna Mountain Project, Cleveland National Forest, San Diego County. Division of Timber Management. San Francisco, California. 10pp.

(5) Trostle, G.C. 1957. Forest Insect Conditions. Mount Laguna Recreation Area, Cleveland National Forest, Appraisal Survey. Pac. SW Forest & Range Expt. Station, Berkeley, California. 9pp.

(6) Wagener, W.W. 1942. Relation of Fungi to Pine Killing, Laguna Mountains Recreation Area, Cleveland National Forest. Bureau Plant Industry, USDA, San Francisco, California. 10pp.

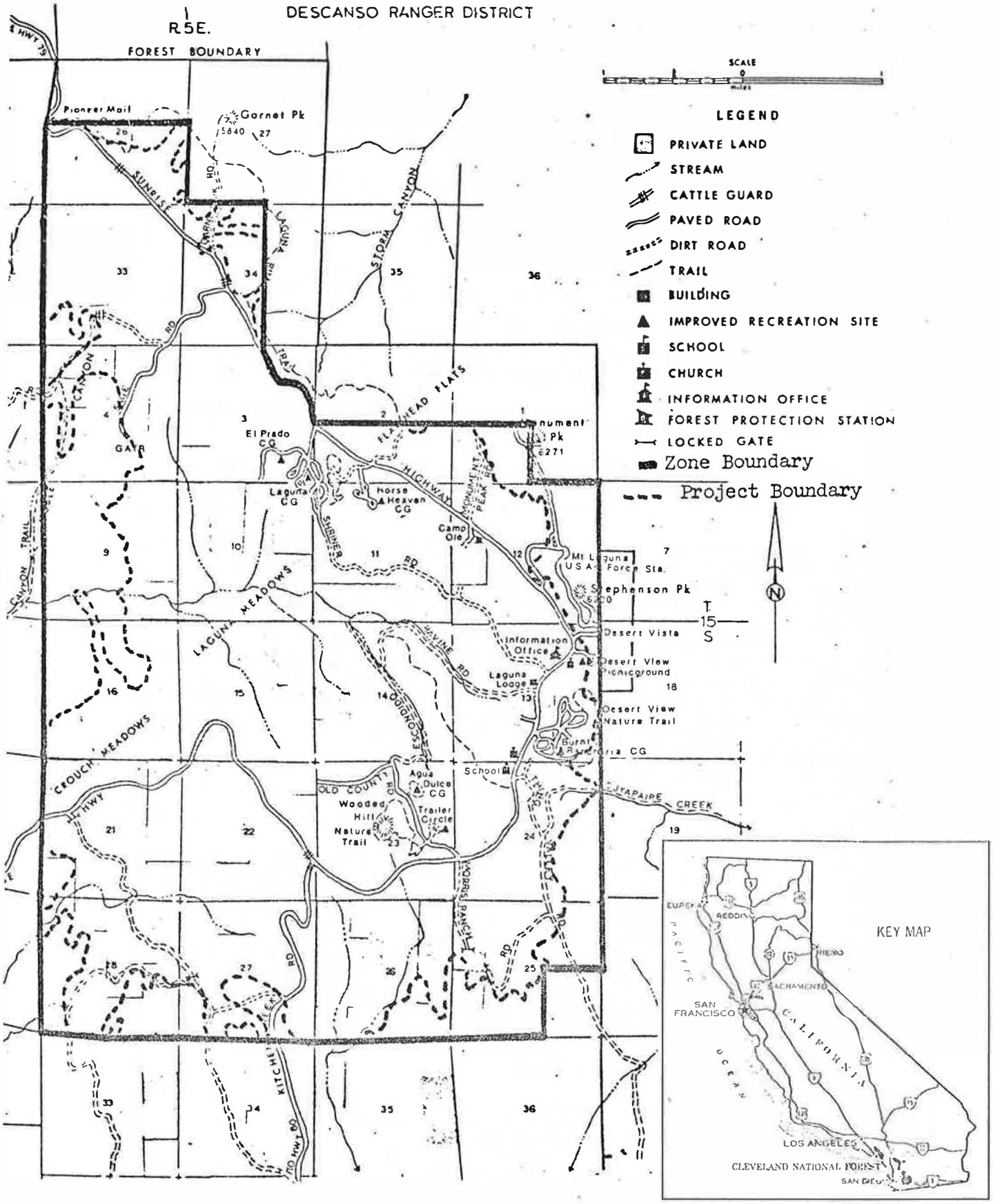

Fig. 1 Laguna Mountain Project Infestation Zone.

BORAX FOR FOMES ANNOSUS CONTROL

ACTIVE INGREDIENT:

Sodium Tetraborate Decahydrate.....($Na_2B_4O_7 \cdot 10H_2O$).... 100.00%

[Boric Oxide (B_2O_3) Equivalent.....37.50%]

FOR CONTROL OF FOMES ANNOSUS IN PINE AND FIR STANDS

It has been established that the fungus, Fomes annosus, often infects cut conifer stumps following thinning or cutting operations, and that the fungus can spread from infected stumps to residual trees in the stand.

Several chemical agents have been used to limit the development of Fomes annosus. Research has shown that Borax prevents establishment and growth of Fomes annosus in cut stumps of pine and fir. Borax, a granular, technical chemical, is widely available from distributors of industrial chemicals. It offers a low-cost, convenient, and safe method of limiting losses to Fomes annosus.

Before using Borax for stump treatment control of Fomes annosus infection, contact local, State or Federal Forest Service authorities to verify most economical and efficient methods and materials for your situation.

DIRECTIONS FOR USE

Use of Borax for this purpose is limited to pines in the Eastern States; in California and adjacent areas of Nevada, to pines, true firs, and associated conifers occuring in the stand being treated.

Borax should be applied to stump surface of the cut tree as soon after felling as practicable. For most efficient use, apply immediately after cutting but do not delay treatment more than two days.

Best method of application is to sprinkle material "salt-shaker" style on the freshly cut stump surface. Complete coverage, including exposed side areas and any splinters, is necessary. "Shaker-top" applicators are available in most farm and garden shops in one or two-pound sizes.

Apply only enough Borax to lightly cover stump surface. At proper rates of application, one pound of granular Borax will adequately cover 50 square feet of stump surface; that is, 260 six-inch stumps, 158 eight-inch stumps, 80 ten-inch stumps, or 60 twelve-inch stumps.

Moisture in the exposed wood from freshly cut stumps, dew, or rain, will dissolve the Borax and leach it into the wood.

CAUTION: KEEP OUT OF REACH OF CHILDREN

CAUTION: Use care and caution in handling and applying all pesticides. May be harmful if swallowed. Follow directions and do not over apply, waste or spill. Do not store pesticides with feed or foodstuffs, or where children or animals may have access. Destroy all containers when empty. Multiwall paper containers in which Borax is packed may be burned when empty. Wash hands, face, and clothing after use.

Borax carelessly spilled or applied to cropland or growing plants — including trees and shrubs — may kill or seriously retard plant growth. Do not contaminate any body of water by direct application.

NOTICE

Because of many varying conditions affecting use and application, such as location, seasonal weather, soil composition and type of vegetation, manufacturer warns buyer that these and other conditions may impair or vary the results or effects of this product. In any event, complete elimination of Fomes annosus is not guaranteed. Neither manufacturer nor seller shall be liable in respect to any injury or damage suffered by reason of the use of this product for a purpose not indicated by the label or when used contrary to the directions or instructions hereon nor with respect to breach of any warranty not expressly specified herein. Buyer accepts this material subject to these terms, and assumes all risk of usage and handling except when used or handled in accordance with this label. Neither manufacturer nor seller makes, and their employees, and agents are not permitted to make, any representations or warranties, express or implied by law, not specifically set forth herein.

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